CLAIMS

1. A method for collecting water from ambient air, the method comprising:

providing at least one condensation surface for contact with the ambient air;

passing a gas into an enclosed space containing a gaseous mixture of the gas and refrigerant vapour evaporated from a liquid refrigerant such that further refrigerant vapour evaporates into the enclosed space from the liquid refrigerant, and heat is thereby drawn into the refrigerant from the condensation surface cooling the condensation surface to, or below, the dew point of the water in the ambient air;

passing the gaseous mixture from the enclosed space;

contacting the cooled condensation surface with the ambient air to effect condensation of water from the ambient air onto the condensation surface; and

collecting the condensed water.

2. A method according to claim 1 further comprising condensing the refrigerant vapour in the gaseous mixture passed from the enclosed space back into liquid refrigerant to separate the refrigerant vapour from the gas, returning the gas from the gaseous mixture to the enclosed space for generating more of the gaseous mixture, and recirculating the liquid refrigerant condensed from the gaseous mixture.

3. A method according to claim 2 wherein the gaseous mixture is passed from the enclosed space into contact with a liquid absorbent that absorbs the gas from the gaseous mixture thereby forming a solution, and the gas is separated from the solution for the return of the gas to the enclosed space and recycling of the liquid absorbent for contact with more of the gaseous mixture.

4. A method according to claim 2 or 3 wherein the liquid refrigerant condensed from the gaseous mixture is recirculated concurrently with the passage of the gas into the enclosed space and passage of the gaseous mixture from the enclosed space into contact with the liquid absorbent, such that the condensation surface is cooled in a continuous cycle.

5. A method according to any one of claims 1 to 4 wherein the liquid refrigerant is agitated as the gas is passed into the enclosed space.

6. A method according to claim 5 wherein the agitation of the liquid refrigerant is achieved by bubbling the gas through the liquid refrigerant into the enclosed space.

7. A method according to any one of claims 1 to 6 further comprising monitoring temperature of ambient air flowing from the condensation surface, and adjusting the flow rate at which the ambient air flows into contact with the condensation surface to a desired flow rate to promote the condensation of the water from the ambient air onto the condensation surface.

8. A method according to claim 2 wherein the ambient air is cooled by contact with the condensation surface and the cooled ambient air is used for cooling the refrigerant vapour in the gaseous mixture passed from the enclosed space, to facilitate condensing the refrigerant vapour back into the liquid refrigerant.

9. A method according to claim 8 wherein the refrigerant vapour is condensed in a condenser and the method further comprises adjusting flow rate of the ambient air flowing from the condensation surface to promote the condensation of the refrigerant vapour.

10. A method according to claim 9 wherein the flow rate of the ambient air flowing from the condensation surface is adjusted relative to a flow rate of the ambient air flowing into contact with the condensation surface.

11. A method according to claim 9 or 10 comprising monitoring the flow rate of the ambient air flowing from the condensation surface to evaluate whether it needs to be adjusted to promote the condensation of the refrigerant vapour in the condenser, the monitoring comprising:

measuring pressure within the condenser;

measuring temperature within the condenser; and

assessing the measured pressure and the measured temperature.

12. A method according to any one of claims 1 to 11 wherein the gas is ammonia gas.

13. A method according to any one of claims 1 to 12 wherein the liquid refrigerant is iso-butane.

14. An apparatus for collecting water from ambient air, the apparatus comprising:

at least one condensation surface for contact with the ambient air;

an evaporator for receiving liquid refrigerant and defining an enclosed space for a gaseous mixture of refrigerant vapour evaporated from the liquid refrigerant and a gas;

an inlet opening into the evaporator for passage of the gas into the space to cause further evaporation of the liquid refrigerant into the space such that heat is drawn into the liquid refrigerant from the condensation surface, and the condensation surface is thereby cooled to, or below, the dew point of the water in the ambient air to effect condensation of water from the ambient air onto the condensation surface for collection of the water; and

an outlet for passage of the gaseous mixture from the space.

15. An apparatus according to claim 14 further comprising a separation system for separating the gas in the gaseous mixture from the refrigerant and condensing the refrigerant vapour back into liquid refrigerant, for return of the gas to the enclosed space in the evaporator and recycling of the liquid refrigerant to the evaporator.

16. An apparatus according to claim 15 wherein the separation system comprises a condenser for receiving the gaseous mixture from the evaporator and condensing the refrigerant vapour in the gaseous mixture back into liquid refrigerant, the condenser being adapted to receive liquid absorbent and facilitate contact of the gaseous mixture with the liquid absorbent for adsorption of the gas into the liquid absorbent to form a solution and thereby separate the gas from the refrigerant vapour.

17. An apparatus according to claim 16 wherein in use, the condenser houses a bath comprising a layer of the liquid refrigerant and a layer of the solution, and the condenser is adapted for receiving the gaseous mixture for contact of the gaseous mixture with the liquid absorbent to form the solution, prior to passage of the solution into the bath.

18. An apparatus according to claim 17 wherein the liquid refrigerant has a lower density than the solution, and the solution separates from the layer of liquid refrigerant into the layer of the solution.

19. An apparatus according to claim 16 or 17 further comprising a mixer unit arranged within the condenser for receiving the liquid absorbent, wherein the mixer unit is adapted for creating a flow of the liquid absorbent over a surface of the mixer unit for facilitating the contact of the gas with the liquid absorbent.

20. An apparatus according to claim 19 wherein the mixer unit has an open well for receiving the liquid absorbent and providing the flow of the liquid absorbent down the surface of the mixer unit with overflow of the liquid absorbent from the well.

21. An apparatus according to claim 19 or 20 wherein the mixer unit is adapted for promoting turbulence in the liquid absorbent as the liquid absorbent flows down the surface of the mixer unit to enhance absorption of the gas by the liquid absorbent.

22. An apparatus according to any one of claims 10 to 21 wherein the mixer unit is mounted on gimbals arranged within the condenser for maintaining the mixer unit in a substantially upright position.

23. An apparatus according to any one of claims 16 to 22 wherein the separation system further includes a separation reservoir for evaporation of the gas from the liquid absorbent, the separation reservoir comprising:

a housing;

an inlet for passage of the liquid absorbent into the housing, the gas evaporating from the liquid absorbent within the housing; and

an outlet for return of the gas evaporated from the liquid absorbent to the evaporator.

24. An apparatus according to claim 23 wherein the separation reservoir is adapted for being heated to facilitate evaporation of the gas from liquid absorbent.

25. An apparatus according to any one of claims 16 to 24 further comprising a pump system for elevating the liquid absorbent to an elevated position for flow of the liquid absorbent to the condenser for contact with further of the gaseous mixture from the evaporator, the pump system comprising:

a heating reservoir for receiving the liquid absorbent and being heated for causing the liquid absorbent to be forced from the heating reservoir;

a riser tube for receiving the liquid absorbent from the heating reservoir upon the heating reservoir being heated; and

a collection reservoir arranged at the elevated position and into which the tube opens for collection of the liquid absorbent, the collection reservoir being adapted for passage of the liquid absorbent from the collection reservoir to the condenser.

26. An apparatus according to claim 25 wherein the collection reservoir has a first outlet for passage of the liquid absorbent from the collection reservoir to the condenser, an interior space for receiving the gas together with absorbent vapour which evaporate from the liquid absorbent with travel along the riser tube, and a further outlet for passage of the gas separated from the liquid absorbent from the collection reservoir to the evaporator.

27. An apparatus according to any one of claims 16 to 26 further comprising a control system for controlling flow rate of the ambient air into contact with the condensation surface, the control system comprising:

a temperature sensor for determining temperature of the ambient air flowing from the condensation surface, the control system being adapted to monitor the temperature determined by the temperature sensor and adjust flow rate of the ambient air flowing into contact with the condensation surface to promote condensation of the water from the ambient air onto the condensation surface.

28. An apparatus according to claim 27 adapted to direct the ambient air flowing from the condensation surface to the condenser, and wherein the control system further includes an adjustable air intake operable to adjust flow rate of the ambient air flowing from the condensation surface to the condenser relative to a flow rate of the ambient air flowing into contact with the condensation surface, to thereby alter temperature and pressure within the condenser to promote the condensation of the refrigerant vapour.

29. An apparatus according to claim 28 wherein the control system further includes a temperature sensor for measuring temperature in the condenser, and a pressure sensor for measuring pressure within the condenser, and the control system is further adapted to assess the temperature measured by the temperature sensor and the

pressure measured by the pressure sensor, and operate the adjustable air intake to alter the flow rate of the ambient air flowing to the condenser.

30. An apparatus according to any one of claims 14 to 29 wherein the gas is ammonia gas.

31. An apparatus according to any one of claims 14 to 30 wherein the liquid refrigerant is iso-butane.

32. An evaporator for effecting condensation of water from ambient air, the evaporator comprising:

at least one condensation surface for contact with the ambient air;

a housing for receiving liquid refrigerant and having an enclosed interior space for a gaseous mixture of refrigerant vapour evaporated from the liquid refrigerant and a gas;

an inlet for passage of the gas into the space to cause further evaporation of the liquid refrigerant into the enclosed space such that heat is drawn into the liquid refrigerant from the condensation surface and the condensation surface is thereby cooled to, or below, the dew point of the water in the ambient air to effect condensation of the water from the ambient air onto the condensation surface for collection of the water; and

an outlet for passage of the gaseous mixture from the enclosed space.

33. An evaporator according to claim 32 wherein the, or each, condensation surface is a surface of a cooling fin respectively, and the housing of the evaporator comprises:

an upper region for receiving the gaseous mixture of the gas and the refrigerant vapour;

a lower region for being at least partly filled with the liquid refrigerant and being spaced from the upper region; and

at least one conduit that opens at one end into the upper region of the housing and at an opposite end into the lower region; and

wherein the, or each, cooling fin is arranged between the upper region and the lower region for contact with the ambient air.

34. An evaporator according to claim 33 comprising a plurality of the cooling fins, the cooling fins being spaced apart from each other and arranged one next to another for contact with the ambient air.

35. A method for separating a gas from a refrigerant vapour in a gaseous mixture, the method comprising:

providing a condenser adapted for condensing the refrigerant vapour into liquid refrigerant, the condenser housing a mixer unit for receiving a liquid absorbent for absorbing the gas and which is adapted for facilitating contact of the liquid absorbent with the gaseous mixture;

passing the gaseous mixture into the condenser to effect the condensing of the refrigerant vapour; and

passing the liquid absorbent to the mixer unit whereby the liquid absorbent contacts the gaseous mixture such that the gas is absorbed into the liquid absorbent forming a solution of the liquid absorbent and the gas.

36. A method according to claim 35 wherein the gas comprises ammonia gas.

37. A method according to claim 35 or 36 wherein the liquid refrigerant is iso-butane.

38. A condenser for separating a gas from a refrigerant vapour in a gaseous mixture, the condenser comprising:

a housing for receiving the gaseous mixture and condensing the refrigerant vapour into liquid refrigerant; and

a mixer unit arranged within the housing for receiving a liquid absorbent for absorbing the gas to form a solution of the gas and the liquid absorbent, the mixer unit being adapted for facilitating contact of the gaseous mixture with the liquid absorbent.

39. A mixer unit for mixing a gas with a liquid absorbent for absorbing the gas from a gaseous mixture of the gas and a refrigerant vapour to separate the gas and the refrigerant vapour, the mixer unit comprising:

a mixer body for receiving the liquid absorbent and facilitating contact of gaseous mixture with the liquid absorbent for absorption of the gas, the mixer body being adapted for facilitating contact of the gaseous mixture with the liquid absorbent.

40. A method for providing heating from an apparatus during operation of the apparatus, the method comprising:

passing a gas into an enclosed space containing a gaseous mixture of the gas and refrigerant vapour evaporated from a liquid refrigerant, such that further refrigerant vapour evaporates into the enclosed space from the liquid refrigerant;

passing the gaseous mixture from the enclosed space to a condenser for condensing the refrigerant vapour in the gaseous mixture back into liquid refrigerant;

returning the gas from the gaseous mixture to the enclosed space;

recirculating the liquid refrigerant condensed from the gaseous mixture for evaporation into the enclosed space; and

drawing off heat from the condenser to provide the heat.

41. A method according to claim 40 further comprising:

passing a liquid absorbent into contact with the gaseous mixture in the condenser such that that gas is absorbed from the gaseous mixture into the liquid adsorbent to form a solution;

passing the solution from the condenser; and

separating the gas from the liquid absorbent in the solution passed from the condenser for the return of the gas to the enclosed space and recycling of the liquid absorbent from contact with more of the gaseous mixture.

42. A method for providing cooling from an apparatus during operation of the apparatus, the method comprising:

providing at least one cooling surface for contact with ambient air;

passing a gas into an enclosed space containing a gaseous mixture of the gas and refrigerant vapour evaporated from a liquid refrigerant, such that further refrigerant vapour evaporates into the enclosed space from the liquid refrigerant, and heat is thereby drawn into the liquid refrigerant from the cooling surface cooling the cooling surface;

passing the gaseous mixture from the enclosed space;

contacting the cooled cooling surface with the ambient air to effect cooling of the ambient air; and

using the cooled ambient air to provide the cooling.

43. A method according to claim 42 wherein the gaseous mixture is passed from the enclosed space into a condenser for condensing the refrigerant vapour in the gaseous mixture back into liquid refrigerant, and wherein the gas from the gaseous mixture is returned to the enclosed space and the liquid refrigerant condensed from the refrigerant vapour is recirculated for evaporation into the enclosed space.

44. A method according to claim 43 further comprising:

passing a liquid absorbent into contact with the gaseous mixture in the condenser such that that gas is absorbed from the gaseous mixture into the liquid adsorbent to form a solution;

passing the solution from the condenser; and

separating the gas from the liquid absorbent in the solution passed from the condenser for the return of the gas to the enclosed space and recycling of the liquid absorbent from contact with more of the gaseous mixture.

45. A solar heating device for providing solar heating, the device comprising:

at least one pair of spaced apart reservoirs for being differentially heated by solar heat from the sun and being pivotable about a pivot axis, one or both of the reservoirs being partly filled with a refrigerant;

at least one conduit for passage of the refrigerant from the one reservoir to the other reservoir upon the one reservoir being heated by the solar heat relative to the other reservoir, and return of the refrigerant to the one reservoir upon the one reservoir cooling relative to the other reservoir, the pair of reservoirs being pivoted about the pivot axis in one direction with passage of the refrigerant from the one reservoir to the other reservoir and in an opposite direction with the return of the refrigerant to the one reservoir; and

a reflector for reflecting the solar heat onto an object to be heated, the reflector being arranged to rotate about an axis of rotation in a first direction for substantially maintaining the reflection of the solar heat on the object with the pivoting of the pair of reservoirs about the pivot axis in the one direction, and being rotatable about the axis of rotation in an opposite direction as the pair of reservoirs are pivoted in the opposite direction about the pivot axis.